

NIDO: Navegación e interacción con el usuario en el desarrollo de sistemas de información Web: Métodos, Técnicas y Herramientas

TIC2003-00369

Jesús Torres*
Coordinador

María José Escalona*
Participante

Antonia María Reina*
Participante

Abstract

NIDO (Navegación e Interacción con el usuario en el Desarrollo de sistemas de Información Web: Métodos, Técnicas y Herramientas) is a research project with two main lines of research. The first one is to continue with the research developed in the coordinated projects MENHIR (TIC97-0593-C05-03) and DOLMEN (TIC2000-1673-C06-03), while the second one is related to the opening of new research lines in order to cover specific aspects associated with the specification and development of web systems.

The rapide advance of the internet has made web systems become one of the main lines of work in companies which produce software, and also, an important research line in universities, research centres and companies' research departments. Therefore, one of the main aims of our research project is to define a methodological environment suitable to deal with navigational characteristics and user's interaction in web systems. This approach has to cover aspects of the whole life cycle, from requirements to implementation and testing.

Navigation and user interface are critical aspects in web systems. In order to make easier the application of our work, a second important goal is to give support to our approaches with tools that allow this kind of applications to be automated. Besides, in our work the definition of references and metrics to measure the grade of quality of the results is also a fundamental objective. Finally, an important characteristic of our project is the work with companies and our big interest in applying our results to real projects.

Keywords: Web engineering, advanced separation of concerns, user interfaces, user centered design

1 Project goals

When we asked for the NIDO Project, we tried to achieve mainly seven aims:

* E-mail: jtorres@lsi.us.es

* E-mail: mjescalona@us.es

* E-mail: reinaqu@lsi.us.es

- 1- To describe a modelling language to deal with the different aspects involved in web systems. For that, we thought that, on the one hand, it was necessary to study the current situation in order to evaluate which ones were the best proposals and, on the other hand, to detect the gaps in current web engineering approaches.
- 2- To define a web approach to deal with requirements in web systems. This work is a continuation of the definition of NDT (Navigational Development Techniques)[8] [9] [11] , a web proposal which started to be developed in the DOLMEN project and has to be completely defined in the NIDO project.
- 3- To define metrics to measure the quality of web systems. This work must start with an analysis of the current situation and, depending on their situation, some of them could be assumed, others could be adapted and, maybe, some new metrics should be defined to evaluate the results of the approach defined in the second goal.
- 4- To propose a framework to define the navigation aspect with the precondition of keeping the separation of concepts to decrease the complexity of the system.
- 5- To define a language to describe information in order to prototype and implement graphical user interfaces.
- 6- To develop a set of tools to support the application of our results. These tools should give support to all the life cycle of a web project.
- 7- To apply our results to real projects, mainly in projects related to e-learning and digital libraries environments, because they are complex systems which have web interfaces.

With these objectives in mind, we have proposed a methodology of work based on the division of tasks among the people in the project. We have divided the tasks into three main groups and each one is composed of different tasks. The structure of this division is showed in table 1.

BLOCK 1: Definition of the web modelling language	
	Task 1.1. Definition of our proposal NDT
	Task 1.2. Definition of the NDT process, its phases and techniques
	Task 1.3. Enrichment of NDT with quality metrics
BLOCK 2: Development of the navigation and the user interfaces	
	Task 2.1. Comparative studies of approaches to deal with aspects
	Task 2.2. Implementation of the navigation
	Task 2.3. Definition of a language to represent interfaces
BLOCK 3: Development of tools	
	Task 3.1. Development of the NDT-Tool to support NDT
	Task 3.2. Development of a tool to define and implement the navigation aspect
	Task 3.3. Development of a tool to generate user interfaces
	Task 3.4. Application of results

Table 1. Tasks in the project

With these tasks, we can cover all our objectives. Thus, table 2 shows a traceability matrix [11] which resumes the fulfilled objectives for each task. Each row represents an objective while each column corresponds to one task. An “X” expresses that the objective is partially or completely gotten with the task.

needed to centre more the fact. At the beginning of 2004, a new more concrete survey was published in the Journal of Web Engineering [7]. This survey, developed in collaboration with Dr. Nora Koch of the University of Munich, was the start point of our work in tasks 1.1 and 1.2.

During the first year of the project, NDT has been completely defined. We have finished tasks 1.1 and 1.2 and its results were presented as part of the thesis of Dr. María José Escalona [11]. This thesis was submitted in October 2004 and it got the European mention. The development of NDT and also the European thesis opened several collaborations with companies and universities, that are going to be analysed in the following sections.

NDT is a web proposal focused mainly in the first phases of the life cycle and it covers an important gap in the web environment, the treatment of requirements. The treatment of requirements of NDT is very detailed, because it is based on a group of patterns. A pattern is a special template with specific fields for each kind of requirement.

The structured way of defining requirements in NDT allows us to apply systematic processes for the generation of models. In this sense, NDT is a powerful approach to give support to the development team. Furthermore, its processes and techniques can be applied using NDT-Tool, a tool-CASE that supports completely NDT and that allows us to obtain some results. The structured way of dealing with requirements and the support in the development process are the best features of NDT. For this reason, it has been accepted by several companies and it was applied to several real projects during these years.

2.2 Development of navigation and user interface

In order to accomplish task 2.1, a survey of the different proposals for separating concerns at the implementation level [16] has been made. Afterwards, a need for raising the level of abstraction was detected, and as result, another survey of current aspect modelling languages [19] was made. As a consequence, it was concluded that current aspects modelling languages were too close to AspectJ constructs (AspectJ is a general-purpose extension to Java for implementing aspects) and they were valuable for platforms that are able to separate concerns, but we need specify models in a platform independent way.

Therefore, in [18] the use of MDA [15] and domain specific languages for specifying concerns at the Platform Independent Modelling Level was proposed. Finally, the architecture of a framework for developing applications with such features was proposed in [17]. These previous steps are pursuing the fulfilling of task 2.2.

Also, it is important to highlight the work in the usability of user interfaces field to accomplish task 2.3. This research work has as a starting point the different references that, since 1990, stand up for the use of models and simulation to support the development of user interfaces. Concretely, the research line in our group is oriented to the application of modelling and simulation techniques to the User Centre Design with the aim of improving the usability of interfaces. Thus, the product is intended to be enhanced from the improvement of the process, using modelling and simulation as tools. Therefore, some future goals of this line are: firstly, the obtaining of suitable models to improve the understanding and the application of such processes; secondly, the experimentation with the effects that a decision related to the usability can cause during the software development, and, finally, the evaluation of the application of User Centre Design processes in organizations which develop interactive systems. In this area the publications [12] and [13] should be emphasized.

Finally, we should stick out the presentation of the Phd Thesis titled “Simulación Realista Del Comportamiento Mecánico De Telas Utilizando El Método De Elementos Finitos” by Dr. Juan Manuel Cordero in April 2005. This thesis develops a cloth simulator where the NDT

methodology has been proved. The configuration environment of the simulation is complex with multiple design and visualization aspects. This environment allows us to check and redefine some patterns of the generation of interfaces language.

With all these results, we can conclude that the tasks planned for this block has been covered. Obviously, this group of tasks is quite theoretic and it is not a finished work. Its results are the base of the next block, overall for tasks 3.2 and 3.3 that are going to be analysed in the next section.

2.3 Development of tools

The planning of the last group has changed a little, mainly the one related to task 3.4. The fulfilling of the these tasks depends on the development of the previous tasks, thus, the obtaining of results depends completely on the rest of the work.

The first task of this block, the development of NDT-Tool, is a consequence of the NDT. NDT-Tool is a tool case to apply NDT. During the definition of NDT, a first version of NDT-Tool has been introduced [11] [10] . This first version had some problems because it was developed using Visual Basic and Access. Nowadays, and after checking it by means of its application to real projects, we have started a new release developed with JSP and MySQL. This new version is currently at the end of the development process and, now, about the 75% of the tool is available.

Related to task 3.2 and the advanced separation of concerns line, the framework to deal with different concerns has just started to be developed. Task 3.3 has a similar situation.

As we have mentioned previously, the planning of task 3.4 has changed a little. At the beginning, we had proposed starting with the application of results in the middle of the project. However, we have obtained several previous results, mainly in block 1. So, we have applied our results and tools in some real projects as it was shown in previous sections.

3 Results indicators

In this section, we are going to try to introduce a group of indicators to analyse the aims that have been achieved during this first period. We are going to group them depending on their nature.

3.1 Staff in training

In our project Staff in training can be divided into two main groups. The first one is composed of researchers who are working directly in the NIDO project. At the beginning, In NIDO there were four doctors: Dr. Jesús Torres, Dr. Manuel Mejías, Dr. Juan Antonio Ortega, Dr. Mariano González. The project started with four doctoral students, but nowadays, two of them, Dr. María José Escalona and Dr. Juan Manuel Cordero, have presented their thesis. Besides, during this period, two new doctoral students have been included in the project, Javier Gutierrez and Juan Antonio Álvarez.

The second group is made up of students who are working in some of the lines of the NIDO project, but they are not included in the project. In this situation, we have several final degree project students that are applying NDT to real projects.

3.2 Publications

During our first period of work, we have published several papers and results in different research forums. In table 4 we summarise these results, and in order to obtain a better understanding, they have been grouped according to their type.

Phd. Thesis	Journals	Books	International Conferences	National Conferences	Others
2	5	0	10	6	1

Some of the most relevant publications can be consulted in the reference section.

3.3 Relations with companies and patents

The high grade of applicability of our work has caused us to have good relations with companies. The first important collaboration has been with the government of Andalusia. During this year, we have applied NDT in two small projects involving the Andalusian Institute of Historical Patrimony. These projects, available on the web, deal with the management of information about the Andalusian historical patrimony via web. The first one manages the historical thesaurus, while second one deals with information about historical authors in Andalusia.

Recently, a new collaboration with the Andalusian Government, concretely with the Consejería de Cultura, has been signed. In this case, we are going to apply our results to a big project, named Mosaico, that has just started.

Another important landmark is our parallel PETRI project. This project as a main goal the development of a system to measure the grade of handicap of some patients and it is being developed with Alcer Foundation and Visual Informática S.L. In this project, NDT has been the used methodology to define requirements and to analyse the system.

Also, NDT is being assumed to be applied to web projects by several companies, like DMR Consulting.

In other line, NDT and NDT-Tool have been registered in the Intellectual Property Register in the last June.

3.4 Relations with universities and international projects

Our group, as it has been mentioned in previous sections, has several and important relations with other universities. As international collaboration, we have some important works with the University of Nice, concretely with the group of Dr. Jean Luois Cavarero. Nowadays, we have several publications together oriented to the requirements treatment.

Another important relation is the one with the University of Munich, concretely with Dr. Nora Koch. Our recent collaborations are oriented to work in a new requirement proposal that comprises NDT and UWE, her web approach.

These previous works are also related to the collaborations with the Politechnical University of Milan, concretely with Dr. Piero Fraternali and his group.

As national collaborations, we have a good relations with the Politechnical University of Valencia, concretely with the group of Dr. Oscar Pastor and Alicante, specially with Dr. Cristina Cachero.

During 2004, several meetings have been celebrated with these groups. In February 2004, Dr. María José was working with Dr. Oscar Pastor's group in Valencia, and, in the same month, a

meeting between members of the universities of Seville, Nice and Valencia, was celebrated in Seville.

From this meeting, we started to work in the definition of a proposal for an European Project in conjunction with other five European universities: Seville, Nice, Valencia, Geneva and Florence and the University of Casablanca. This project has a main aim the development of an e-learning platform for the University of Casablanca. In October 2004, a meeting between these universities was celebrated in Casablanca. The project was presented last January and, nowadays, we are waiting for the answer.

Currently, we are developing a new European collaboration between the universities of Geneva, Nice and Seville. This project is more oriented to companies. In December, a meeting in Geneva was celebrated with ten companies from Monaco, France, Switzerland and Spain, in order to introduce the project aims. Furthermore, a new meeting with other ten companies is going to be hold in September. The idea key is to select the most interesting companies and to develop an approach to deal with the maintenance of software projects.

4 References

- [1] L.Cavarero, M.J. Escalona "Metrics for Dynamics: How to improve the Behaviour of an Object Information System". Proceedings of the 6th International Conference on Enterprise Information System (ICEIS'2004).ISBN: 972-8865-00-7.Vol. 3. pp. 344-349. Porto, Portugal. May, 2004
- [2] J.M. Cordero, J.J. Perea, J. Torres, J. A. Ortega . Simulación del comportamiento dinámico de telas usando el método de los elementos finitos. . XIV Congreso Español de Informática Gráfica. ISBN: 84-688-6998-8. Sevilla. 2004.
- [3] J.M. Cordero. Realistic Cloth Animation Using The Mass Spring Model. Game Programming Gems 5. ISBN: 1-58540-352-1.
- [4] J.J. Gutierrez, M.J. Escalona, M. Mejías, J. Torres, J.A. Álvarez .Comparative Analysis of Methodological Proposes to Systematic Generation of System Test Cases from System Requirements.Proceedings of the 3rd International Workshop on System Testing and Validation.(SV'2004). ISBN: 3-8167-6677. pp. 151-160. Paris, France. December, 2004.
- [5] J.J. Gutierrez, M.J. Escalona, M. Mejías, J. Torres. Aplicando técnicas de testing en sistemas para la difusión Patrimonial. Actas del V Congreso Nacional de Turismo y Tecnologías de la Información y las comunicaciones (TURITEC'2004). ISBN: 84-608-0181-0. pp. 237-252. Málaga, Spain. October, 2004.
- [6] M.J. Escalona, J.L.Cavarero."Building Class Diagrams Systematically". To be published in the Proceedings of the 7th International Conference on Enterprise Information Systems (ICEIS 2005). Miami, USA. May, 2005.
- [7] M.J. Escalona, N. Koch. Requirements Engineering for Web Applications: a Comparative Study. Journal of Web Engineering. ISSN: 1540-9589.Vol. 2. pp. 193-212. Ed. Rinton Press. February, 2004
- [8] M.J. Escalona, M. Mejías, J. Torres. Developing Systems with NDT & NDT-Tool. Proceedings of the 13th International Conference on Information System Development (ISD'2004).ISBN: 9986-05-762-0.pp. 149-159. Vilnius, Lithuania. September, 2004.
- [9] M.J. Escalona, A. M. Reina, J. Torres, M. Mejías. NDT: A methodology to deal with the navigational aspect at the requirements phase. Proceedings of the Workshop in Aspect-Oriented Requirements Engineering and Architecture Design. Vancouver, Canada. October, 2004.

- [10] M.J. Escalona, J. Torres, M. Mejías, A.M. Reina NDT-Tool: A CASE Tool to deal with Requirements in Web Information Systems. Proceeding of the International Conference on Web Engineering (ICWE 2003). Lecture Notes in Computer Science (LNCS 2722). Spain, 2003.
- [11] M.J. Escalona. Modelos y técnicas para la especificación y el análisis de la navegación en sistemas software. Ph. European Thesis. Department of Computer Languages and Systems. University of Seville. Spain, 2004.
- [12] N. Hurtado, M. Ruiz, J. Torres, J. M. González. Revisión de lenguajes declarativos para la descripción de interfaces de usuario independientes del dispositivo. *Interacción Persona-Ordenador*, nº 5. 2004.
- [13] N. Hurtado, M. Ruiz, J. Torres. Towards Interactive Systems Usability Improvement through Simulation Modeling. 6th International Workshop on Software Process Simulation and Modeling. ProSim 2005. co-located with ICSE 2005. St Louis, MO. USA. ISBN 3-8167-6761-3
- [14] N. Koch. Software Engineering for Adaptive Hypermedia Applications. Ph. Thesis. FAST Reihe Softwaretechnik Vol(12). Germany, 2001.
- [15] OMG: MDA Guide, OMG doc.ab/2003-05-01.
- [16] A. M. Reina, J. Torres. "Components+Aspects: A General Overview". *Revista Colombiana de Computación*. Publicado por la Universidad Autónoma de Bucaramanga. Vol 5(1). Junio, 2004. pp 77-95. ISBN: 1657-2831.
- [17] A. M. Reina, J. Torres, M. Toro, J. A. Álvarez. "Separación de conceptos y MDA: Arquitectura de un framework". I Taller sobre Desarrollo de Software Dirigido por Modelos, MDA y Aplicaciones (DSDM'04). Celebrado junto con las Jornadas de Ingeniería del Software y Bases de Datos (2004). Málaga, España. November, 2004. Publicado por la Universidad Politécnica de Valencia. ISBN: 84-688-8870-2. Eds. Vicente Pelechano, Antonio Vallecillo, Javier Muñoz, Joan Fons.
- [18] A. M. Reina, J. Torres, M. Toro, M. J. Escalona. "Modelando aspectos con lenguajes específicos de dominio". Segundo Taller de Desarrollo de Software Orientado a Aspectos (DSOA04). Celebrado junto con las Jornadas de Ingeniería del Software y Bases de Datos (2004). Málaga, España. November, 2004. Publicado por la Universidad de Extremadura como Informe Técnico TR-23/04. pp. 91-98. ISBN: 84-688-8889-3. Eds. Lidia Fuentes, Ana Moreira, Juan Manuel Murillo.
- [19] A. M. Reina, J. Torres, M. Toro. "Towards developing generic solutions with aspects". The 5th Aspect-Oriented Modeling Workshop (AOM). Workshop held in Conjunction with the UML 2004 Conference. Lisbon, Portugal. November, 2004.